Intrasentential Prosody:

Conjunction, speech rate and sentence length

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Résumé

In this paper, I will discuss prosody between two adjacent sentences in a discourse, especially intrasentential phonological changes such as Flapping, the Linking-r and the Intrusive-r. I will propose an alternative analysis to Nespor and Vogel (1986), who assume U-Restructuring. The model of syntax-phonology interface to be proposed consists of the mapping of constituent structure onto phonological boundaries and the boundary deletion rule. It naturally explains the various factors affecting intrasentential prosody, including conjunction types, speech rate and sentence length.

1. Introduction

In this paper, I will discuss prosody between two adjacent sentences in a discourse. I will propose a model of syntax-phonology interface, which naturally explains various factors in prosody: conjunction types, speech rate and sentence length.

2. Phonological Rules Operating across Sentences

2.1. Prosodic Category Utterance: Nespor and Vogel (1986)

Nespor and Vogel (1986: 235), citing Kahn (1980) and Harris (1969), show that some phonological rules may operate across sentences. First, consider the data from Mexican Spanish (cf. Harris 1969: 60). Voicing Assimilation may occur on *dos* in (1a) but not in (1b) where a pause (| |) occurs after the first sentences.

(1) a. Los dos. Dámelos. [losz ðósz dámelos]
'Both of them. Give them to me.'
b. Los dos. | | Dámelos. [losz ðós dámelos]

Second, Flapping, the Linking-*r* and the Intrusive-*r* may occur across the pairs of sentences, as shown in (2a), (2b) and (2c), respectively.

(2) a. It's late. I'm leaving. --> ... la[*ɾ*] I'm ...
b. Where's Esther? I need her. --> ... Esthe[r] I ...
c. Call Anna. It's late. --> ... Anna[r] It's ...

Nespor and Vogel (1986: 221) assume that the topmost prosodic constituents, Utterance (U), is delimited by the beginning and end of the syntactic constituent X^n. They argue that these phenomena shown in (1) and (2) occur when Us are restructured into a single unit. For example, the process in (2a) can be represented as follows:

(3) [$_U$ It's late] [$_U$ I'm leaving] --> [$_U$ It's la[*ɾ*] I'm leaving]

However, these rules do not apply across any pair of sentences. Nespor and Vogel propose the two phonological conditions on U restructuring as shown in (4).

(4) a. The two sentences must be relatively short.
b. There must not be a pause between the two sentences.

They also argue that the phonological unit U cannot be isomorphic with any syntactic constituent because X^n is by definition the largest constituent in syntax.

2.2. *Problems of the Prosodic Category Analysis*

Nespor and Vogel's explanation seems to be successful, but it has some problems. First, as they admit by themselves, the condition (4a) is rather vague since they cannot give more precise indications about the length of the sentence involved. They just point out that phonological restructuring does not occur when the sentences are long. Second, they also just mention that rate of speech appears to play a role in a type of trade-off relation with length. This is nothing but an observation. Their analysis does not answer the question why this is the case.

3. Bare Mapping Analysis of Discourse Prosody

3.1. *Bare Syntax-Phonology Mapping and Prosodic Phrasing*

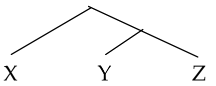
In this section, I will propose an alternative analysis of discourse prosody, which includes a syntax-phonology mapping rule and a boundary deletion rule.

The mapping rule I have proposed is (5) (cf. Tokizaki 1999, 2005).

(5) Interpret boundaries of syntactic constituents [...] as prosodic boundaries / ... /.

For example, the rule (5) maps the right branching structure (6a) into the PF representation (6b), where X, Y, and Z schematically represent a word.

(6) a. [[X] [[Y][Z]]]



b. / / X / / / Y / / Z / / /

In (6b), we have two prosodic boundaries before X, three between X and Y, two between Y and Z, and three after Z.[2]

In this bare mapping theory, prosodic phrasing is to group words by deleting prosodic boundaries between them. The phrasing process can be formulated into the rule shown in (7), where *n* is a variable.

(7) Delete n boundaries between words. (*n*: a natural number)

If we apply (7) to (6b) with *n*=1, 2, or 3, we get (8a), (8b), and (8c), respectively.

(8)	a.	/ X / / Y / Z / /	(*n*=1)	-->	(X) (Y) (Z)
	b.	X / Y Z /	(*n*=2)	-->	(X) (Y Z)
	c.	X Y Z	(*n*=3)	-->	(X Y Z)

In (8a), one boundary is deleted in every sequence of boundaries, and there are two boundaries between X and Y, and one boundary between Y and Z. Thus we get three prosodic phrases (X), (Y), and (Z). In (8b), two boundaries are deleted in every sequence of boundaries, and there is one boundary between X and Y, but no boundary between Y and Z. Thus we get two prosodic phrases (X) and (Y Z). There is no boundary left in (8c) after three boundaries are deleted in every sequence of boundaries. The whole string is contained in a prosodic phrase (X Y Z).

To illustrate how the rules (5) and (7) work with the actual sentences, consider the following sentence:

(9) Alice loves hamsters.

I assume here that phrase structure is bare in the sense of Chomsky (1995). As Chomsky (1995:246) notes, "there is no such thing as a non-

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[2] The basic idea of the rule (7) is not unprecedented. There are similar ideas such as depth of syntactic boundaries (Cheng 1966:150), depth of embedding (Clements 1978: 29), Silent Demibeat Addition (Selkirk 1984:314, 1986:376, 388). However, these analyses cannot hold in the minimalist framework because they assume rather old versions of syntactic structure.

branching projection." Then the phrase structure of the sentence *Alice loves hamsters* is not the X-bar theoretic structure (10a) but the bare structure (10b).

(10) a. $[_{IP}\ [_{NP}\ [_{N'}\ [_{N}\ \text{Alice}]]]\ [_{I'}\ \text{I}\ [_{VP}\ [_{V'}\ [_{V}\ \text{loves}]\ [_{NP}\ [_{N'}\ [_{N}\ \text{hamsters}]]]]]]]$

b. $[_{IP}\ [_{N}\ \text{Alice}]\ [_{I'}\ \text{I}\ [_{VP}\ [_{V}\ \text{loves}]\ [_{N}\ \text{hamsters}]]]]$

I also assume the following convention for invisible syntactic objects:[3]

(11) Phonologically null elements and the constituents made by merging them with other syntactic objects are invisible to phonological rules.

By "phonologically null elements", I refer to trace, PRO, Infl, *v*, and so on. Given the convention (11), I and I′ in (10b) are invisible to phonological rules. I is phonologically null and I′ is made by merging I with VP. Thus phonological rules can "see" only some parts of the structure, which is shown in (12).

(12) $[_{IP}\ [_{N}\ \text{Alice}]\ [_{VP}\ [_{V}\ \text{loves}]\ [_{N}\ \text{hamsters}]]]]$

Following Chomsky (1995) and Collins (2002), I also assume that there are no labels in syntactic structure. With these assumptions, the mapping rule (7) applies to the "completely bare" structure (13).

(13) [[Alice] [[loves] [hamsters]]]

The rule interprets the brackets in (13) and changes them into prosodic boundaries as in (14).

(14) / / Alice / / / loves / / hamsters / / /

Now the phrasing rule (7) deletes a number of boundaries between words to make longer prosodic phrases. If we apply this rule with *n*=1 to (14), it deletes one boundary between words to give (15a). The three words are still separated by boundaries, and each word makes a prosodic phrase by itself.

(15) a. / Alice / / loves / hamsters / / (*n*=1) --> (Alice) (loves) (hamsters)

b. Alice / loves hamsters / (*n*=2) --> (Alice) (loves hamsters)

c. Alice loves hamsters (*n*=3) --> (Alice loves hamsters)

I assume here that the number of boundaries to be deleted (*n*) corresponds to the speed of utterance. The basic idea is that if the speaker utters the sentence faster, the more boundaries are deleted, and the longer phrases we get. If we suppose that *n*=2, that is, when the speaker talks faster, then we get (15b) as the result of applying the deletion rule (7). If *n*=3, the fastest in this case, the whole sentence is included in a prosodic phrase as in (15c), because there is no

[3] Nespor and Scorretti (1984) also argue that empty categories have no effect on the various PF rules.

boundary left between words after deletion.[4] Thus we can capture the relation between the rate of speech and the length of prosodic phrases.

3.2. *Constituent Structure of Discourse*

The bare mapping theory gives us more precise characterization of the phenomena. First, let us consider the phrase structure above the sentence. Larson (1990: 594) discusses the following data on coreference:[5]

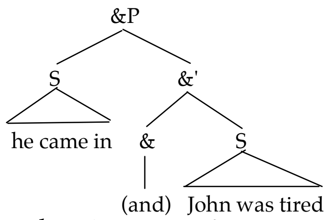
(16) a. * He came in and John was tired.
b. * He came in. John was tired.

On the basis of parallelism between (16a) and (16b), Larson assumes the following:

(17) a. Intrasentential anaphora between elements α, β depends on the relative hierarchical relations of α, β themselves; intrasentential anaphora between α, β depends on the relative hierarchical relations of the Ss containing α, β.
b. Coordination structures fall under X-bar theory and have conjunctions as their heads.
c. In their default form, discourses are extended coordinations.

Then (16a) and (16b) share the following phrase structure:

(18)



Larson explains the disjoint reference in (16a) and (16b) with the constraint to the effect that “an S containing an R-expression cannot be c-commanded by an S containing a coreferential phrase.”

3.3. *Phonological Representation of Discourse*

As Larson’s analysis of coreference in discourse seems to be on the right track, let us assume that sentences are hierarchically

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[4] See Tokizaki (2006) for the idea that *n* also relates to the levels of prosodic categories. If *n* is larger, then (7) makes larger prosodic domains (e.g. phonological phrases or intonational phrases). With this idea we could dispense with prosodic category hierarchy altogether.

[5] See Tokizaki (1995, 1996) for the discussion of coordinate structure and coreference.

structured into a tree as shown in (18). Then the structure of (2a), for example, is the following:

(19) [$_{\&P}$ [$_{IP}$ [$_{D}$ It's] [$_{A}$ late]] [$_{\&'}$ & [$_{IP}$ [$_{D}$ I'm] [$_{V}$ leaving]]]]

Here, & is the covert version of *and*. As I assumed above, phonologically null elements are invisible to the mapping rule. Then mapping rule applies to the following structure (20a), instead of (19), to give the output (20b).

(20) a. [$_{\&P}$ [$_{IP}$ [$_{D}$ It's] [$_{A}$ late]] [$_{IP}$ [$_{D}$ I'm] [$_{V}$ leaving]]]

b. / / / It's / / late / / / / I'm / / leaving / / /

Notice that there are four boundaries between the sentences in (20b). This number is nearly the smallest between two sentences. As the sentences become longer, the number may increase, as shown in (21).

(21) a. [$_{\&P}$ [$_{IP}$ [$_{D}$ It's] [$_{AP}$ [$_{Adv}$ very] [$_{A}$ late]]] [$_{IP}$ [$_{\&P}$ [$_{N}$ Irene] [$_{\&'}$ [$_{\&}$ and] [$_{D}$ I]]] [$_{I'}$ [$_{I}$ are] [$_{V}$ leaving]]]]

b. / / / It's / / / very / / late / / / / / / Irene / / / and / / I / / / / / are leaving / / / /

In (21b), there are six boundaries between the sentences. The additional two boundaries are due to the AP and &P boundary in (21a). If the boundary deletion rule with n=4 applies to (20b) and (21b), we get (22a) and (22b), respectively.

(22) a. It's late I'm leaving (n=4)

b. It's very late / / Irene and I / are leaving (n=4)

Let us assume that Flapping is blocked if one or more boundaries intervene between [t] and the following vowel. Then we can explain straightforwardly why Flapping may occur between the short sentences in (22a) but not between the long sentences in (22b).

Moreover, we can also explain why speech rate appears to play a role in a type of trade-off relation with length. As the speaker utters sentences faster, the number n in the boundary deletion rule increases. Thus Flapping could occur even in (21b) if all the boundaries between the sentences are deleted by the deletion rule with n=6. On the other hand, if the sentences in (20b) are uttered in slower rate than in the rate of (22a where n=4), the boundary deletion rule with a smaller value for n cannot delete all the four boundaries between the sentences, as shown in (23).

(23) It's late / I'm leaving (n=3)

In this case, Flapping is blocked by the remaining boundary. Thus we can explain optionality of intrasentential phonological process including the factors of speech rate and length of sentences straightforwardly.

Furthermore, the bare mapping theory can give us a profound insight into the syntax and semantics of conjunctions. Nespor and Vogel (1986: 241) argue that *or* and *but* behave differently from *and*, *therefore*, and *because* in the possibility of intrasentential phonological changes. As we have seen above, Flapping, the Linking-*r*, and the Intrusive-*r* may occur across a pair of sentences. This is the case with the following examples where two sentences are conjoined implicitly with *and*, *therefore*, and *because*, as shown in (24), (25), and (26), respectively.

(24) a. You invite Charlotte. I'll invite Joan. --> ... Charlo[*r*] I'll ...
b. Isabelle's a lawyer. I'm a doctor. --> ... lawye[r] I'm ...
(25) a. It's late. I'm leaving. --> ... la[*r*] I'm ...
b. I'm shorter. I'll go in the back. --> ... shorte[r] I'll ...
(26) a. Take your coat. It's cold out. --> ... coa[*r*] It's ...
b. Hide the vodka. Alvin's coming. --> ... vodka[r] Alvin's ...

Interestingly enough, sentences implicitly conjoined with *or* and *but* typically do not permit the application of these rules.

(27) a. Stop that. I'll leave otherwise. --> * ... tha[*r*] I'll ...
b. Finish your pasta. I'll eat it otherwise. --> * ... pasta[r] I'll ...
(28) a. It's late. I'm not leaving though. --> * ... la[*r*] I'm ...
b. I didn't invite Peter. I should have though. --> * ... Pete[r] I ...

Note that, in each example of (27) and (28), Nespor and Vogel add the words *otherwise* and *though* to the second sentence. This is because the cases are extremely difficult to find where *or* and *but* relation is implied between sentences. Citing Cooper and Paccia-Cooper's (1980: 163) analysis of the example below, Nespor and Vogel argue that negative semantic relation between two sentences influence speech timing.

(29) a. The tall yet frail student flunked chemistry.
b. The tall and frail student flunked chemistry.

Here, it is more likely that pausing will occur immediately before a negative conjunction (*yet*, *but*) than before a positive one (*and*). Posner (1973) also suggests that pausing with negation may reflect the speaker's need for an extra interval of processing time, necessary to access lexical information that is more distant from the lexical information just spoken. Nespor and Vogel conclude that adjacent Us may be joined into a single U when there exists a positive semantic relation between the Us.

Nespor and Vogel's observation seems accurate and penetrating, but it does not give us a principled explanation of the difference between positive and negative conjunctions. I will show how the difference can be explained in the bare mapping theory below.

The phrase structure of (27a) and (28a) is (30a) and (30b), respectively.

(30) a. [$_{CNJP}$ [$_{VP}$ [$_{V}$ Stop] [$_{D}$ that]] [$_{CNJ'}$ [$_{IP}$ [$_{D}$ I'll] [$_{V}$ leave]] [$_{CNJ}$ otherwise]]

b. $[_{CNJP}$ $[_{IP}$ $[_{D}$ It's] $[_{A}$ late]] $[_{CNJ'}$ $[_{IP}$ $[_{D}$ I'm] $[_{NegP}$ $[_{Neg}$ not] $[_{V}$ leaving]]] $[_{CNJ}$ though]]

The mapping rule applies to (30a) and (30b) to give (31a) and (31b), respectively.

(31) a. / / / Stop / / that / / / / / I'll / / leave / / / otherwise / /

b. / / / It's / / late / / / / / I'm / / / not / / leaving / / / / though / /

Compare these with (20), repeated here as (34), where the relation implied is *therefore*.

(32) a. $[_{\&P}$ $[_{IP}$ $[_{D}$ It's] $[_{A}$ late]] $[_{IP}$ $[_{D}$ I'm] $[_{V}$ leaving]]]

b. / / / It's / / late / / / / I'm / / leaving / / /

The number of boundaries after the first sentence is five in (31a) and (31b) and four in (34b). The extra boundary in (31a) and (31b) is due to the CONJ' boundary in (30a) and (30b) which is made visible by the conjunction at the end of the second sentence. If we apply the boundary deletion rule with n=4 to (31a) and (31b), we get (33a) and (33b), respectively.

(33) a. Stop that / I'll leave otherwise (n=4)

b. It's late / I'm not leaving though (n=4)

Compare these with (22a) with an implied *and*, repeated here as (34).

(34) It's late I'm leaving (n=4)

Thus we correctly predicts Flapping applies in (34) and not in (33a) and (33b).

4. Conclusion

To sum up, we have seen that the bare mapping theory successfully explains when phonological rules operate across sentences. The mapping rule interprets as prosodic boundaries not only syntactic boundaries within a sentence but also those before and after it. If the sentence becomes longer, then it may have more syntactic and prosodic boundaries before and after it. The faster the speaker utters sentences, the more prosodic boundaries are deleted. Thus we can take into account the factors of sentence length and speech rate. Optional application of phonological rules is also explained by changing the number of boundaries to be deleted.

The mapping rule and the boundary deletion rule give us a good model of discourse prosody. They straightforwardly explain the effects of conjunction types, speech rate and the length of sentences.

Selected References

COOPER, W. E. & J. PACCIA-COOPER (1980), *Syntax and Speech*, Cambridge, Mass., Harvard University Press.

LARSON, R. K. (1990), «Double objects revisited: Reply to Jackendoff», *Linguistic Inquiry* 21, 589-632.

NESPOR, M. & I. VOGEL (1986) *Prosodic Phonology*, Dordrecht, Foris.

POSNER, M. I. (1973) *Cognition: An introduction*, Glenview, Ill. : Scott, Foresman.

SELKIRK, E. O. (1984) *Phonology and syntax: The relation between sound and structure*, Cambridge, Mass. : MIT Press.

TOKIZAKI, H. (1999), «Prosodic phrasing and bare phrase structure», *Proceedings of the North East Linguistic Society* 29, vol. 1, 381-395.

TOKIZAKI, H. (2005), «Pause and hierarchical structure in sentence and discourse», Proceedings of IDP05: International Symposium on "Discourse and Prosody as a complex interface"», Université de Province. (CD-ROM, also available at http://www.lpl.univ-aix.fr/~prodige/idp05/idp05_en.htm)

TOKIZAKI, H. (2006), *Linearizing structure with silence : A minimalist theory of syntax-phonology interface*, Doctoral dissertation, the University of Tsukuba.